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AUTHORITY

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AUTHOR: Kaliski, Sylwester

TITLE: The Cauchy problem for an elastic dielectric in a magnetic field

PERIODICAL: Referativnyy zhurnal. Matematika, no. 10, 1962, 58-59, abstract 10B268 (Proc. Vibrat. Probl. Polish Acad. Sci., v. 2, no. 3, 1961, 237-249 [Eng.; summaries in Pol. and Russ.])

TEXT: The article considers the unsteady problem of the deformations of an elastic dielectric in a magnetic field. The mathematical problem consists in the combined integration of a system of Maxwell equations and those of the theory of elasticity. Moreover, in the elastic-theory equations there are volumetric forces of electromagnetic origin, and in the Maxwell system there are additional currents due to the displacement of the charged parts of the dielectric. The author considers the linearized system:

$$\operatorname{rot} \mathbf{h} = \frac{4\pi}{c} \mathbf{j} + \frac{\varepsilon}{c} \frac{\partial \mathbf{E}}{\partial t} + \frac{\varepsilon\mu - 1}{c^2} \frac{\partial}{\partial t} \left[\frac{\partial \mathbf{u}}{\partial t} \times \mathbf{H} \right],$$

$$\operatorname{rot} \mathbf{E} = -\frac{\mu}{c} \frac{\partial \mathbf{h}}{\partial t},$$

$$\mathbf{j} = \lambda_0 \left(\mathbf{E} + \frac{\mu}{c} \left[\frac{\partial \mathbf{u}}{\partial t} \times \mathbf{H} \right] \right), \quad \rho \frac{\partial^2 \mathbf{u}}{\partial t^2} = G \nabla^2 \mathbf{u} + (\lambda + G) \operatorname{grad} \operatorname{div} \mathbf{u} + \frac{\mu}{c} [\mathbf{j} \times \mathbf{H}] + \frac{1}{4\pi c} (\mu\varepsilon - 1) \left[\frac{\partial \mathbf{E}}{\partial t} \times \mathbf{H} \right] + \frac{\mu}{4\pi c^2} (\varepsilon\mu - 1) \left[\frac{\partial}{\partial t} \left[\frac{\partial \mathbf{u}}{\partial t} \times \mathbf{H} \right] \times \mathbf{H} \right] + \mathbf{P},$$

$$\operatorname{div} \mathbf{h} = 0, \quad \operatorname{div} \mathbf{D} = \rho_0,$$

$$\mathbf{D} = \varepsilon \left(\mathbf{E} + \frac{\mu\varepsilon - 1}{c\varepsilon} \left[\frac{\partial \mathbf{u}}{\partial t} \times \mathbf{H} \right] \right)$$

($\vec{H}$ is the primary magnetic field, which is assumed to be constant; $\vec{h}$ is the additional magnetic field due to deformations of the dielectric. The other notations are standard. The order of the full system is 12. In previous works by the author, published in the same journal (RZhMat, 1962, 5B374, 375) the case of a conducting solid was considered, where the deformation current is negligible as compared with the conduction current. The present work deals with the opposite case. If the conduction current

is neglected, then a total system of the twelfth order will break down into four wave equations and one equation of the fourth order, in which the operator of the left-hand part decomposes into the derivative of two second-order operators. New functions of the potential type are also introduced here. The author calls them the resolving ones. The wave equation solutions are known, and the fourth-order equation is reduced to an integral one of the second-order Volterra type. It is noted that the solution is simpler for a dielectric than for a conductor.
[Abstracter's note: Complete translation.]